B. METEOROLOGICAL RESULTS

Because of the prevailing winds to the northwest and southeast, the highest pollution concentrations were in these directions. The proportional concentrations predicted for the Sioux City area are shown in Figure III-10 for sixteen directions. In Table III-1, the pollution concentration at 2 kilometers is compared for each of the sixteen wind directions. Certain directions, such as the southwest and east, receive relatively little pollution regardless of distance from the plant or season. The predominance of wind direction alone guarantees variation in the pollution exposure of various farms. Note that at a given distance from the plant the level of sulfur dioxide concentration is proportional to the level of wet deposition. This proportion only changes with distance from the polluting source.

The level of pollution concentration is predicted to fall rapidly with distance from the plant. As one travels north from the power plant, the sulfur dioxide concentration falls from 683 ug/m^3 two kilometers away to 56 ug/m^3 just ten kilometers away, and to 5.9 ug/m^3 just thirty-five kilometers north. (Table III-2). Thus, the concentration falls to one percent from two kilometers to thirty-five kilometers. Figures III-11, III-12 and III-13 show the relationship of concentration and distance in north-northwest, east and west-northwest directions. (See Figure III-16 for transect locations). If ambient pollution has an effect there should certainly be a difference between the farms close to the power plant and those far away.

The level of wet deposition does not fall nearly as rapidly as the ambient sulfur dioxide concentration. From its maximum at two kilometers from the plant, it falls to ten percent of that only after twenty-five kilometers, and to one percent of the maximum value only after one hundred ten kilometers. Isopleth maps comparing ambient SO_2 to wet deposition are shown in

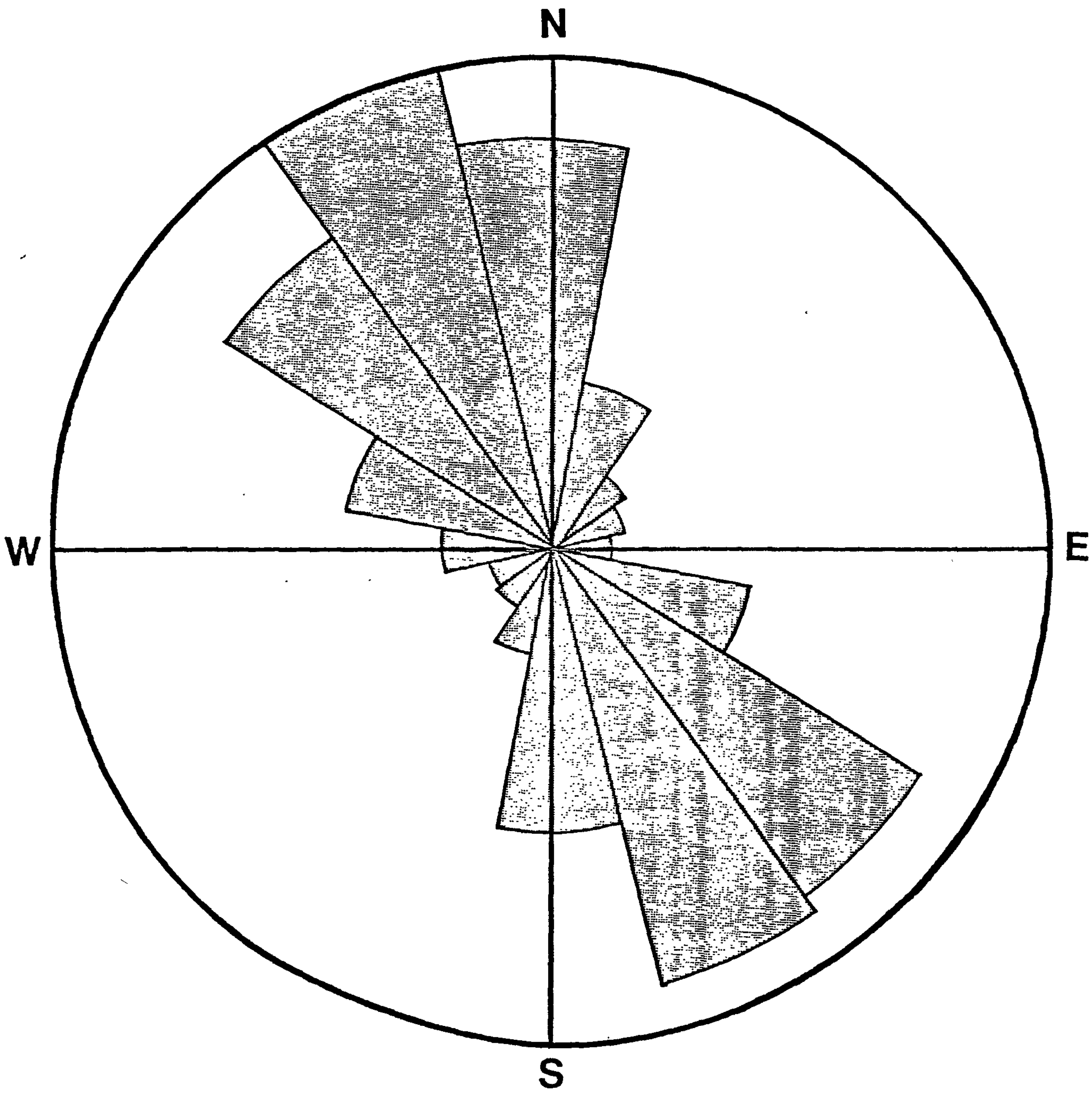

Figure III-10. Sulfur dioxide distribution as predicted by the meteorological model at 10 miles from the source.

TABLE III-1. Added Pollutant Concentration (ug/m^3). Two Kilometers From Source. Based on 1978 Emissions.

Direction From Source	Sulfur Dioxide	Wet Deposition
N	683	18
NNE	326	10
NE	233	9
ENE	168	6
E	244	10
ESE	526	17
SE	877	25
SSE	734	19
S	570	16
SSW	301	10
SW	275	9
WSW	264	9
W	118	7
WNW	587	16
NW	764	19
NNW	817	18

TABLE III-2. Pollution Concentrations Within the Power Plant Plume at Varying Distances North of Sioux City.

Distance (Kilometers)	Sulfur Dioxide	Wet Deposition
2	683	17
4	244	11
6	82	6
10	56	78
15	28	31
20	168	22
25	112	16
30	79	11
35	59	8
40	45	8
50	31	6
60	19	4
70	14	3
80	11	3
90	8	2
100	8	7
120	6	1
140	3	1
160	3	.05

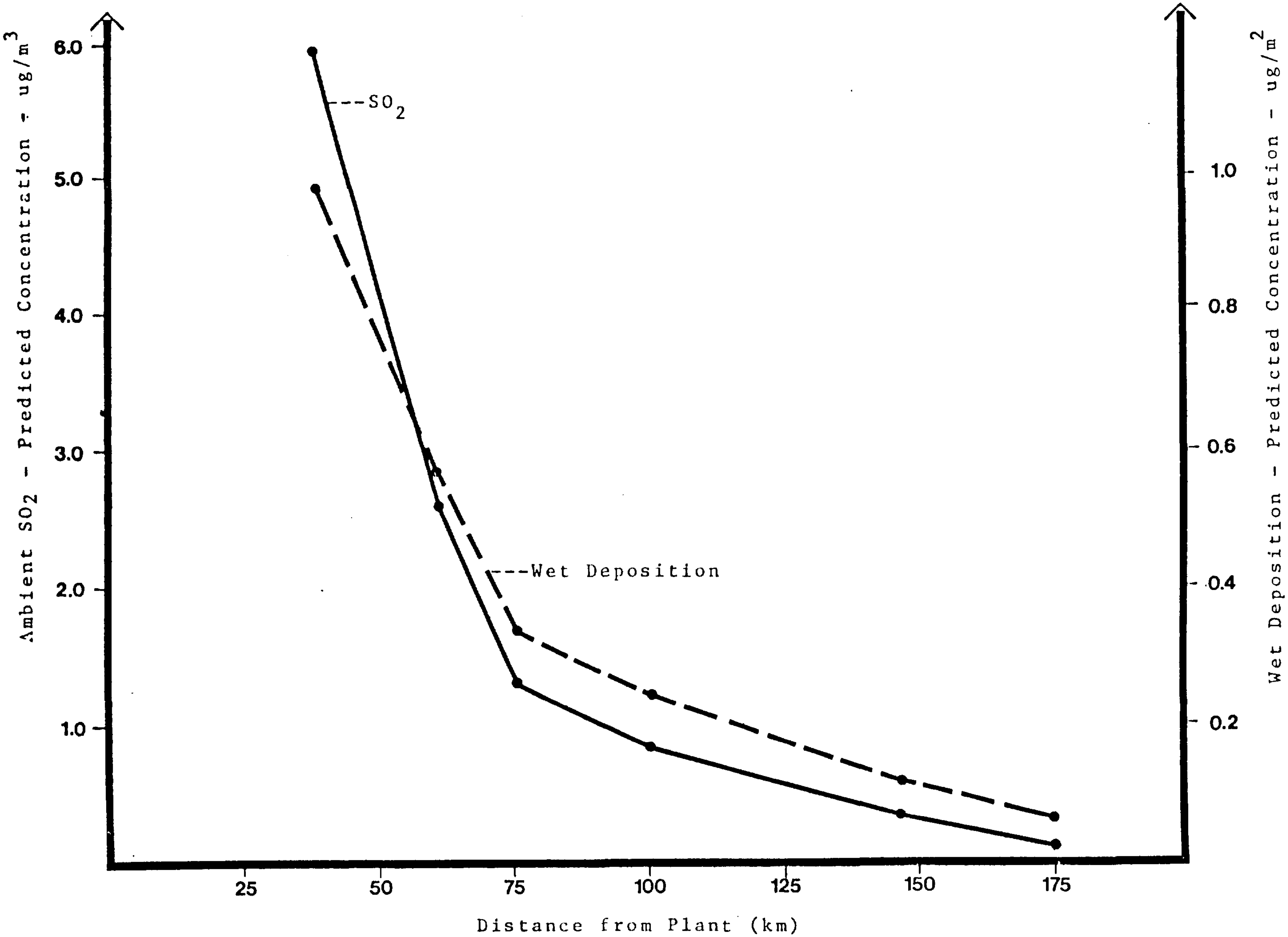

Figure III-11. Sulfur dioxide distributions predicted along Transect A.

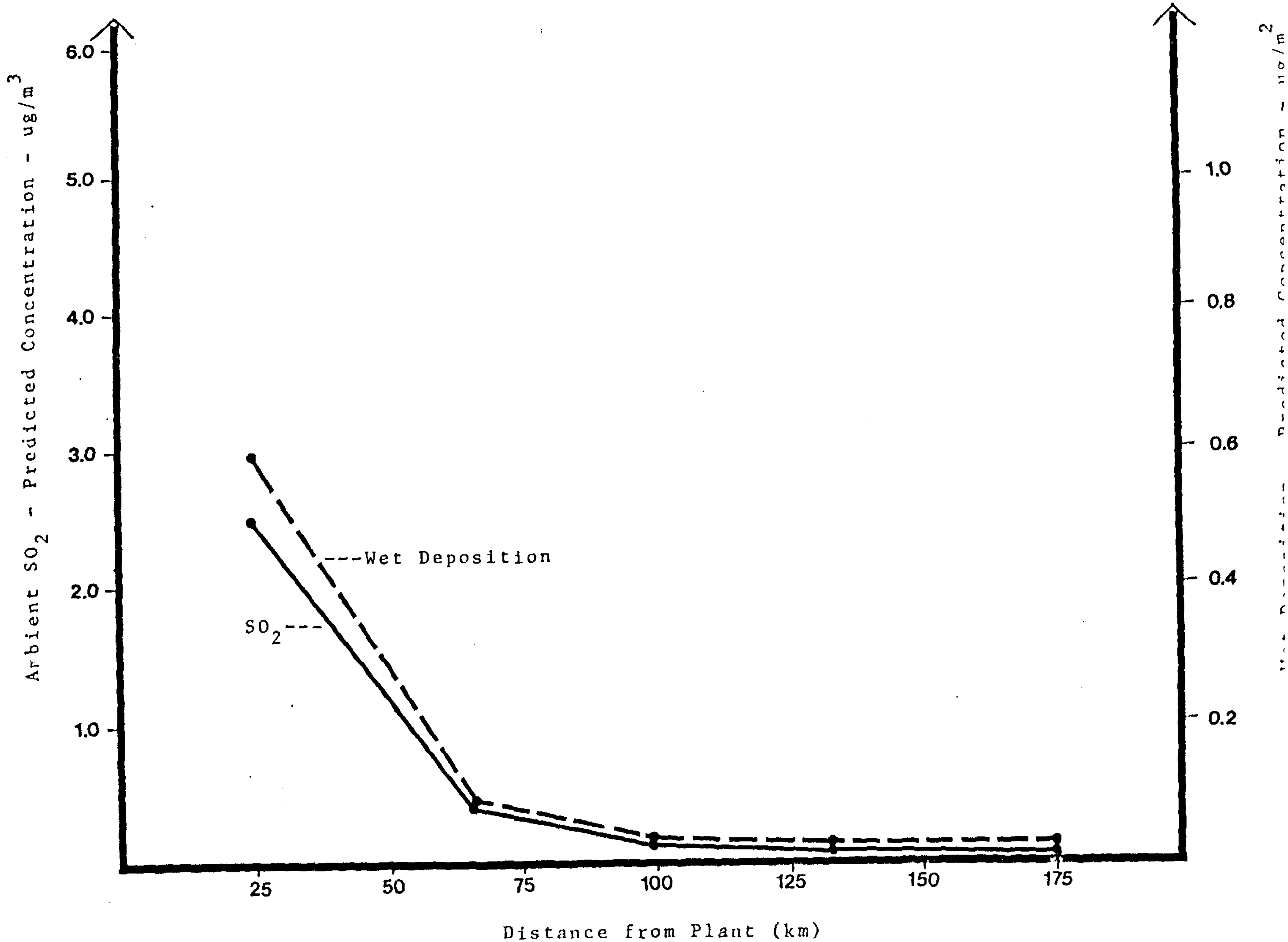

Figure III-12. Sulfur dioxide distributions predicted

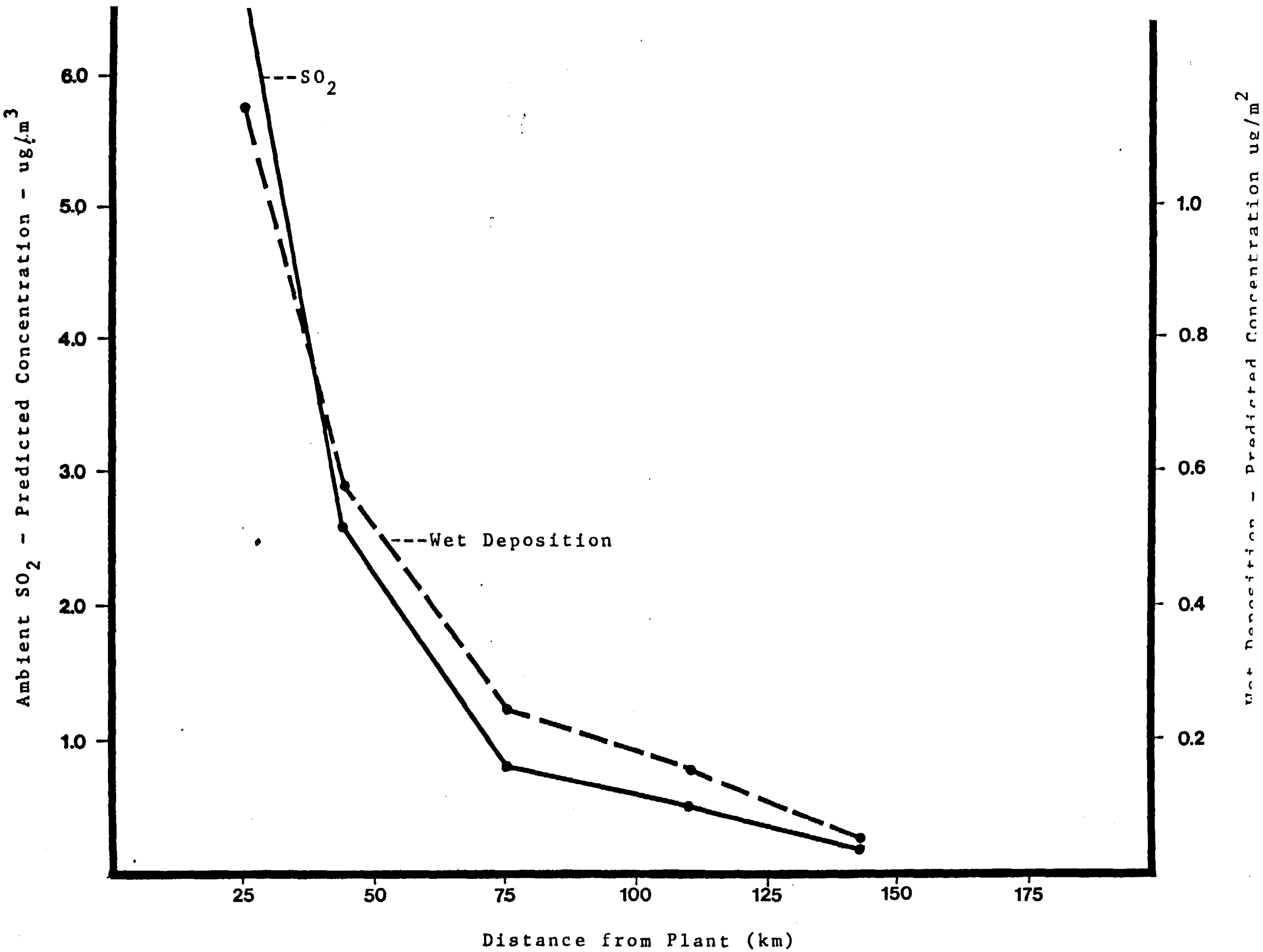

Figure III-13. Sulfur dioxide distributions predicted along Transect C.

Figures III-14 and III-15.

Since wet deposition is relatively slower to fall with distance, it is possible to estimate the relative effect of wet deposition versus ambient pollution by comparing effects at different distances. More distant sites have relatively more wet deposition to ambient pollution. Of course, such comparisons depend heavily on the accuracy of the dispersion model. Wet deposition could simply be acting as a proxy for pollutants capable of travelling greater distances without deposition or transformation. Thus, wet deposition may be a proxy for sulfate, for example.

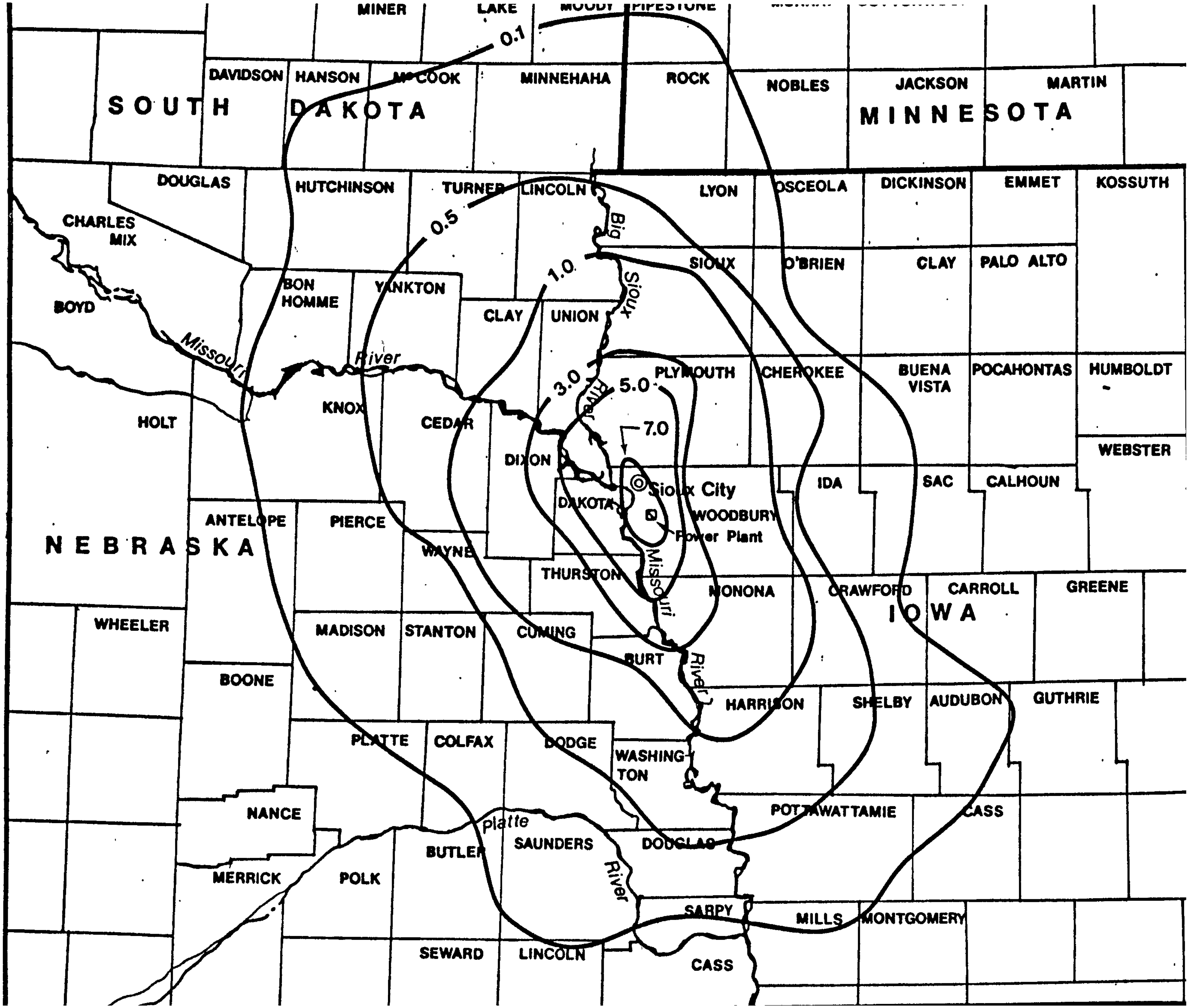

Figure III-14. Predicted added SO_2 ($\mu g/m^3$) concentrations from 1978 source emissions.

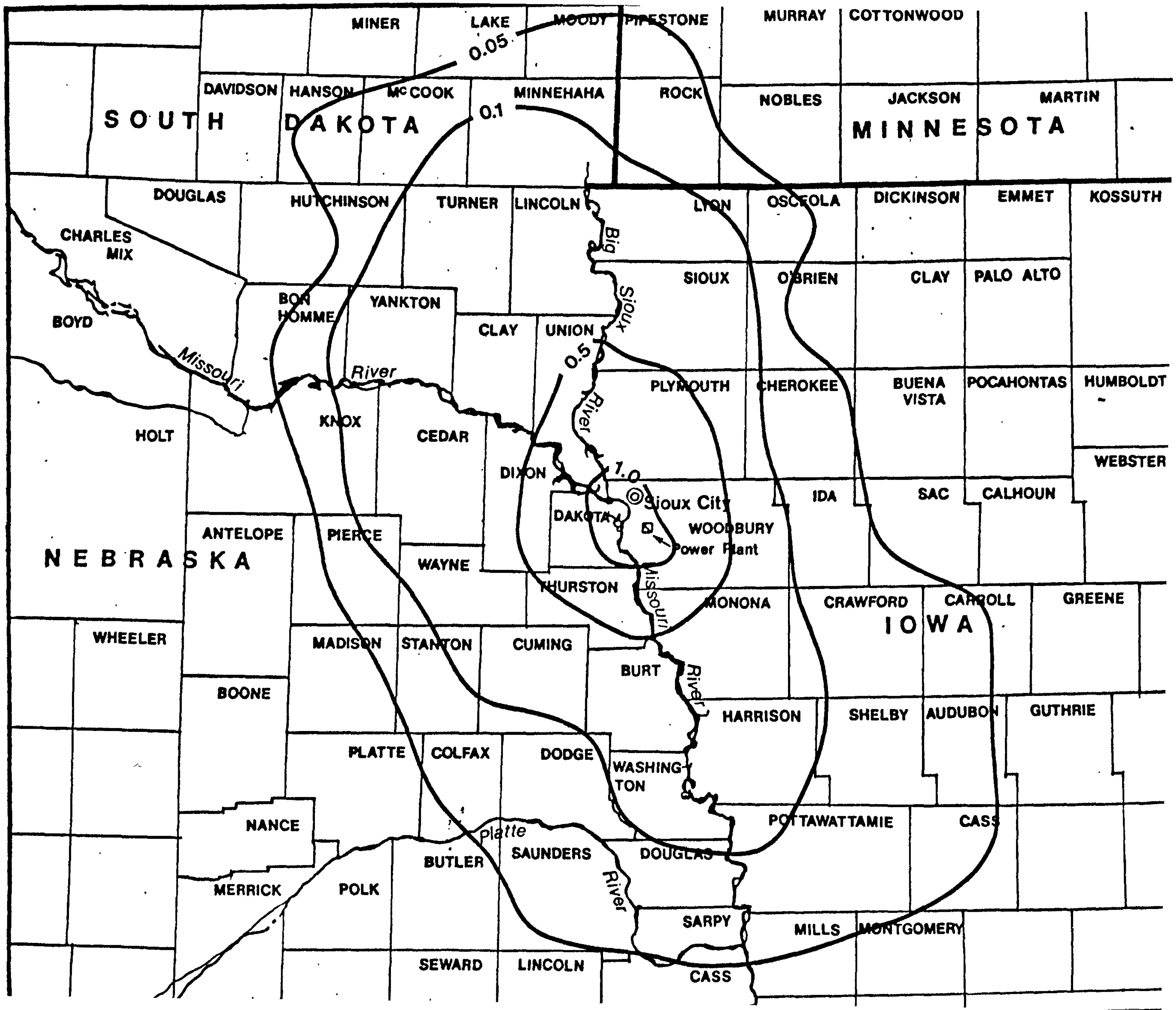

Figure III-15. Predicted wet deposition of SO_2 ($\mu g/m^2$) from 1978 source emissions.

C. MICRODATA ANALYSIS

In this study we perform analyses on two data sets, data from individual farms and that from the Census of Agriculture. The data from the Census is aggregated to the county level and so is referred to in this study as our county data analysis. The data from individual farms was collected through our survey. The farm data lie along three transects from the power plant source, to the north, northwest, and east. (Figure 111-16). Because of prevailing wind patterns (especially during the growing season) , the farms to the northwest receive significantly more pollution from the plant than the farms to the east. As is clear from the meteorological model, it should also be true that farms far from the plant are exposed to much less air pollution.

The purpose of this analysis is to test the effect of air pollution on crop yield per acre. As a proxy for pollution, we use both the distance and the direction of the farm from the power plant. This method will not reveal a precise dose-response curve but it will provide two tests of the significance of a response (one test for direction and the other for distance).

In order to control for undesired influences, data was collected on capital per acre, labor per acre, herbicides, seed types, insecticides, farm size and general soil type (bottomland or hills). Although each of these are potentially important variables, the -consistency of responses by farmers to some of these questions suggest the data may be plagued with measurement error. Our capital and labor measures, for example, may be inaccurate which will lead to their coefficients in the analyses of this sample to be biased towards zero. With better measures, however, these variables could well be important.

Regression analysis with the full data set revealed that most variables were incapable of explaining the variation in yields of

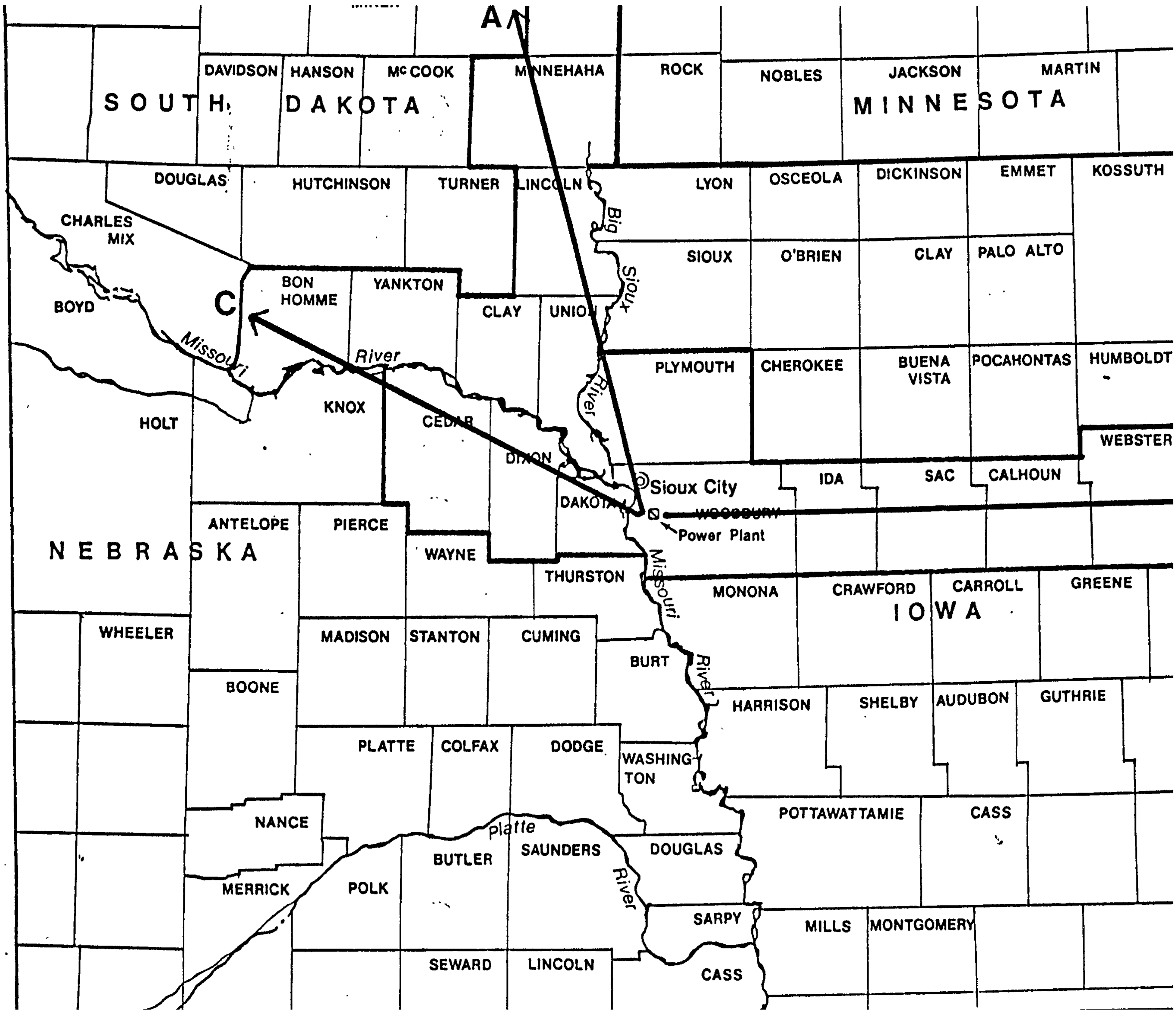

Figure III-16. Transect locations used for survey data.

both corn and soybeans across the sample. The results of the soybean regressions are displayed in Table III-3. Three functional forms were explored: linear, log linear and log-log. In the linear specification (first column), only the size of the farm is significantly different from zero. Soybean yields increase with distance (less pollution) but at virtually undetectable rates. The farms in the northwest direction (more pollution) have lower yields than the eastern farms (less pollution). In the log linear specification, both bottomland and farm size are signficantly different from zero. Soybean yields increase with distance (less pollution) but farms in the northwest (more pollution) have higher yields than farms in the east. In the log-log specification, the coefficients of herbicides and farm size are signficantly different from zero. Yields of soybeans increase with distance and farms in the more polluted areas have lower yields.

Across the specifications in Table III-3 different independent variables become signficant. In none of the regressions are the proxies for pollution signficantly different from zero. However, in two of the three specifications, all of the pollutant coefficients indicate a harmful effect. In the single specification with inconsistent signs, only one of the three coefficients suggested pollution may be beneficial. The responses, though weak, are at least consistent and somewhat robust with respect to the functional form of the regression.

The regressions upon corn yield with the micro data provide no coefficients which are signficantly differently from zero (Table III-4). Our confidence in these regressions is low. Nonetheless, it is interesting to review the impact of the proxies for pollution on crop yield. Only in the linear specification do corn yield increase with distance (lower pollution). In all three specifications, the more polluted directions generally had higher yields. The results for corn are almost exactly opposite the

TABLE III-3. Microdata Analysis of Soybean Yields.[a]

Independent Variables	Multiple Regression Functional Form Linear	Log Linear	Log Log
Herbicides	3.53	.36	.38
	(.72)	(1.27)	(2.30)
Bottomland	-10.9	-1.34	-.74
	(.99)	(2.08)	(1.45)
Farm Size	.03	.002	.50
	(1.95)	(2.28)	(5.09)
Distance	.00001	.0002	.06
	(.00)	(.65)	(.53)
North	-9.6.	-.41	-.31
	(1.37)	(1.01)	(.99)
Northwest	-10.2	.34	.05
	(.80)	(.46)	(.08)
Constant	31.8	2.87	1.00
	(4.26)	(6.64)	(1.10)
R^2	.36	.41	.67
SEE	14.0	.82	.60
Mean	27.0	2.99	2.99

[a]The dependent variable in all three regressions is soybean yield per acre. The t statistics are in parentheses.

TABLE III-4. Microdata Analyses of Corn **Yield.**[a]

Independent Variables	Multiple Regression Functional Form Linear	Log Linear	Log Log
Herbicides	-5.7 (.51)	.03 (.10)	.04 (.19)
Fertilizer	.09 (1.32)	.002 (1.23)	.07 (1.08)
Insecticide	-15.6 (.53)	-.43 (.68)	.15 (.54)
Sulfur	10.3 (.52)	.36 (.83)	.23 (.58)
Bottomland	-28.1 (1.05)	-.93 (1.62)	-.85 (1.58)
Farm Size	.008 (.53)	-.0002 (.62)	--- ---
Distance	.001 (.03)	-.0003 (.65)	-.11 (.60)
North	7.9 (.42	.44 (1.10)	.34 (.86)
Northwest	2.9 (.08)	.61 (.83)	.56 (.77)
Constant	69.0 (2.18)	4.03 (5.93)	4.39 (3.45)
R^2	.22	.25	.25
SEE	37.00	.80	.78
Mean	60.00	3.85	3.85

[a]**The** dependent variable in all three regressions is corn yield per acre. The t statistics are in parentheses.

results for soybeans, whereas, the the strength of the results is weak in both cases, they consistently point to a harmful effect to soybeans but a beneficial effect to corn.

D. COUNTY DATA ANALYSIS

In addition to the analysis of individual farms, we analyzed the data collected by the Census of Agriculture. The Census data has the advantage of observations over time, a large sample, and low cost. The disadvantages of the Census data are the limited number of questions and the aggregation of the data to the county level (to protect confidentiality). Curiously, the amount of data collected by the Census has clearly deteriorated since the 1974 Census. The most recent Census (1978) failed to collect information about fertilizers and reported insecticide and herbicide in more aggregate figures. Further, the most recent Census does not provide crop yield data per acre for a number of counties. A final limitation of the 1978 count is that two years later, only one state has completed its report (the three other state reports are still in press).

The central purpose of the county analysis is to determine whether average pollution levels in a county affect the average crop yields per acre. The average pollution level in each county was measured as the seasonal average pollution level in the geographic center of each county. This aggregation obviously involves some measurement error since the county farms closer to the pollution source obviously were exposed to more pollution than the farms further away. The level of pollution is calculated by an index number which shows the relative amounts of pollution each farm is expected to receive. These index numbers were calculated using the meteorological dispersion model described in Section II-E. The absolute levels of pollution vary each year depending on the level of emissions during that year.

Although the pollution exposures across the counties within one hundred kilometers of the site clearly varied, other variables such as use of fertilizer, lime, insecticides, etc. also varied across farms. In order to control for these unwanted variations, a multiple regression analysis was used. For each year in which Census data are available, 1969, 1974, and 1979, a separate cross-sectional analysis is used, comparing one farm to another during each year. Because separate analyses are performed each year, there is also a time variation which permits detection of factors changing over the period. This time variation is particularly interesting since the emissions from the source increased dramatically between 1969 and 1979. Price of crops were not used in cross-sectional analysis since local prices were assumed to be relatively constant for all farms.

Several functional forms were estimated across counties. The two best fitting forms were the linear and log-log functions. The linear functional form had more significant coefficients in general while the pollution response coefficients were sometimes more significant in the log-log regression. If our purpose was to explain variations in yields across counties, the linear regression would clearly be superior. However, our purpose is to explore the relation between pollution and crop yields. There is unfortunately no unambiguous statistic which points to the preferrable functional form for this purpose. We, therefore, display the results of both sets of regressions although we concentrate our discussion upon the linear functional form.

The regressions displayed in Table III-5 and Table III-6 have linear functional forms which appeared to be superior to logarithmic forms. Several of the independent variables have significant coefficients and the regressions explain a large fraction of the observed variation in crop yields across counties. Although this is no guarantee that one is measuring the effect of air pollution accurately, the significance of the coefficients suggest the model has some relation to the real world.

The regressions of soybean yields suggest that larger farms are more productive. Fertilizer and lime generally increase yield but these relationships are not totally consistent. Insecticides appear to help yield but the results with herbicides are mixed. There are two possible interpretations of the weak effects

Table III-5. County Data Analysis of Soybean **Yield.**[a]

Independent Variables	Crop Year 1969	1974	1979
Farm Size	.09	.08	.46
	(4.40)	(5.53)	(1.65)
Dry Fertilizers	189.0	102.0	---
	(1.33)	(1.78)	---
Wet Fertilizers	728.0	-37.6	---
	(2.24)	(.07)	---
Lime	2.70	1.97	-.005
	(3.95)	(3.09)	(.92)
Insecticide	.06	.04	.71
	(2.11)	(2.73)	(.63)
Herbicide	-.02	.01	.01
	(1.43)	(1.76)	(.04)
Sulfur Dioxide Index	.0367	.209	1.523
	(.62)	(3.44)	(.66)
Acid Rain Index	-0.210	-1.146	-10.670
	(.63)	(2.34)	(.73)
Southern Quadrant	3.07	2.06	---
	(2.14)	(1.56)	---
Constant	17.6	12.0	9.31
	(10.90)	(6.83)	(.16)
R^2	.648	.591	.220
SEE	3.28	3.18	71.6
Mean	29.6	24.5	40.6
No. of Observations	66	66	26

Table III-6. County Data Analysis of Corn Yield.

Independent Variables	Crop Yields 1969	1974	1979
Farm Size	-1.89	.25	.07
	(5.15)	(2.24)	(.84)
Dry Fertilizer	-46.5	408.0	---
	(1.03)	(5.88)	---
Wet Fertilizer	2319.0	109.0	---
	(12.14)	(.83)	---
Lime	-28.4	3.49	-.001
	(4.34)	(1.26)	(1.24)
Insecticide	-.58	-.002	.01
	(1.89)	(.03)	(.16)
Herbicide	.03	.02	.03
	(.28)	(1.18)	(1.15)
Sulfur Dioxide Index	.347		.133
	(.60)	(2.19)	(.66)
Acid Rain Index	-.464	-3.780	-1.020
	(.14)	(2.59)	(.78)
Southern Quadrant	-26.2	-17.6	---
	(1.69)	(3.11)	---
Constant	224.0	-11.2	100.0
	(5.66)	(.92)	(8.15)
R^2	.939	.728	.44
SEE	31.6	11.7	4.6
Mean	99.2	54.0	112.0
No. of Observations	66	66	20

of some of these farm inputs. 1) The inputs are generally beneficial but some types of herbicides or wet fertilizers are more harmful than beneficial. 2) The inputs are always beneficial but farms with particularly bad soils or weed problems use more of the inputs. The inputs thus appear to have harmful effects, but, in fact, are just proxies for the quality of the soils or growing conditions. In either case, most of the farm inputs are probably accounting for unwanted variation (variations in yields unrelated to pollution). The major exception to this is lime which could be used to counteract the effect of acidity from air pollution. The measure of damage in these regressions is consequently the effects from air pollution which still occur, controlling for mitigation efforts. The total damage from air pollution is the sum of these remaining crop damages plus the cost of mitigation.

The effect of air pollution on soybean crop yields are evident in the coefficients for sulfur dioxide, acid rain, and the southern quadrant. The southern quadrant measures the pollution from a medium-sized metropolitan area (Omaha) which lies to the south (about 120 kilometers). Whatever pollution this metropolitan area generates, it appears to be beneficial to soybean crop yields. Of course, this result must be accepted cautiously since the ambient levels of pollutants from Omaha were not precisely measured. Sulfur dioxide from the power plants appears to increase soybean yields. The coefficient is not only positive in all three years, but it increases as the level of emissions rises. Although this may seem a surprising result, it is consistent with findings elsewhere [see Lee *et. al.*(1981), Noggle (1979), Noggle and Jones (1979).]

Through dry and wet deposition, sulfur dioxide may provide sulfur to the soil. With the sulfur-poor soil in the Great Plains, the sulfur dioxide may be providing a needed nutrient of the plant (Tubatukai, 1976). Acid rain, measured in terms of wet deposition, on the other hand, is harmful. More wet deposition, correlated with lower yields both across farms and across time. Whereas sulfur dioxide provides needed sulfur, the chemical form of acid rain appears to damage soybeans.

Another possible interpretation of these results is that the composition of pollution near the pollution source is, on balance, beneficial to soybeans but the composition of pollution far from the plants is generally more harmful. Acid rain may be a proxy for other long range pollutants (such as sulfate).

Examination of Table III-6 suggests similar patterns as in Table III-5. Several farm inputs significantly increase corn yields but the evidence is mixed. Thus, the inputs could be proxies for the original conditions of individual farms or true measures of ineffective farm products (see for example the insecticide coefficient). Crop yields rise with the level of sulfur dioxide across farms in all three years studied. With corn, however, the size of those coefficients falls as the pollution level increases. Acid rain, as with soybeans, is harmful to corn yields. The size of this coefficient rises between 1969 and 1974 but falls in 1979. The results of this corn analysis thus parallel the soybean analysis except for the coefficients estimated on 1979 data. However, the 1979 data for corn is particularly poor quality (fewer observations and less information) so that it should not be given equal weight. The other major difference between corn and soybeans is that yields are lower for corn in the southern quadrants (nearer Omaha).

Both corn and soybeans exhibit beneficial effects of sulfur dioxide and harmful effects of wet deposition. Except for the 1979 corn coefficients, these results are consistent both across farms in a given year and across time. Although it is always possible that the pollution may be a proxy for some other factor, the consistency of the cross-sectional and time evidence certainly increases the reliability of the result.

In order to quantify the dose-response function, it is necessary to adjust the pollution index each year for the level of emissions. These adjusted coefficients are displayed in Table IV-7. The beneficial dose-response of corn to sulfur dioxide increases through 1974 and then drops dramatically in 1978. The harmful response of corn to acid rain rises dramatically in 1974 only to fall by an order of magnitude in 1978. There is no apparent reason for these wide swings of corn yields in response to pollution. The intertemporal variation appears to reflect the lack of precision in the estimation procedure at least with respect to corn.

The soybean coefficients in Table III-7 reveal an interesting pattern. The size of the coefficients rises by a factor of five between 1969 and 1974 and then doubles again in 1978. Thus, the potency of a unit of sulfur emissions is growing. Interestingly enough, it is growing in proportion to the tons of coal being burned. The total tons of coal increased slightly more than five fold between 1969 and 1974 and about two and a half times between 1974 and 1979. The fact that effects increased in proportion to the tons of coal burned rather than the amount of sulfur dioxide released suggest it is not sulfur which is affecting crop yield, but rather some other component of air pollution. Changes in non-sulfur components of coal composition may, therefore, account for some of the variation.

In order to test whether substantial mitigation is occuring on the farms, we asked farmers whether they were concerned about air pollution. Virtually every farmer thought the air pollution from the power plant was inconsequential to his production. Obviously, if the air pollution is considered unimportant, it is unlikely farmers spent substantial resources consciously mitigating its effects.

TABLE III-7. Dose-Response Functions.

CORN

	1969	1974	1978
Sulfur Dioxide[a]	5.688	7.957	.493
Acid Rain[b]	7.806	5.400	3.978

SOYBEANS

	1969	1974	1978
Sulfur Dioxide[a]	.601	2.986	5.640
Acid Rain[b]	3.442	16.37]	39.518

[a]The dose-response measure is in bushels per acre per 100 ug/m^3 of sulfur dioxide at ground level.

[b]The dose-response measure is in bushels per acre per 100 ug/m^3 of sulfur dioxide washed out by rain.

If farmers were concerned about the harmful effects of acid rain, one option they could pursue is to add lime to their soils *to* counteract the acidity. In order to test whether farmers were adding lime to mitigate air pollution, we ran two regressions, one including lime as an independent variable and the other excluding it. The regression with lime measures the dose-response of fields without mitigation. The regression without lime adjusts the dose-response curve to include mitigation. Thus, if mitigation through adding lime is significant, the regressions with lime should have larger negative pollution coefficients than the regressions where lime is excluded. Examining Table III-8, it is apparent that the dose-response effects are larger in each regression when lime is excluded. The evidence suggests that farmers do in fact mitigate the harm of acid rain by adding lime to their soil.

TABLE III-8. Mitigation and Dose-Response Functions
Unmitigated Effect/Mitigated Effect (bushels/100 ug/m^3)

CORN

	1969	1974
Sulfur Dioxide	5.688/1.057	7.957/6.400
Acid Rain	-7.806/-5.639	-54.000/-44.285

SOYBEANS

	1969	1974
Sulfur Dioxide	.601/1.656	2.986/2.542
Acid Rain	-3.442/9.262	-16.371/-13.800

IV. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The field analysis of air pollution and corn and soybean crop yields indicates a subtle and indistinct relationship. Crop yields fall slightly with increasing exposure to air-pollution, but this effect is neither simple nor systematic. We find that the dose-response effect varies with distance from the plant, and that it varies across years in proportion to the amount of coal burned, not sulfur emitted, and is sensitive to mitigation by farmers.

On a net basis, greater exposures to air pollution correlated to lower corn and soybean yields per acre. This effect was not totally consistent, however, so that one cannot be certain air pollution truly damages crop yields.

In order to determine which component of the air pollution from the power plant was actually harmful, we tracked both sulfur dioxide and wet deposition from the plume. Sulfur dioxide, a primary pollutant, tends to be most heavily concentrated near the plant and concentrations fall rapidly with distance. Wet deposition, because it is virtually independent of the vertical dispersion of the plume, tends to be more evenly spread across more distant locations. Thus, wet deposition behaves more like secondary or long transport pollutants. Regressions including both sulfur dioxide and wet deposition indicated that the sulfur dioxide was beneficial, but wet deposition was harmful. We conclude from this that the probable agent of damage from the power plant tends to be a long transport material. It could be wet deposition itself in the form of acid rain or it could be other small particles such as sulfate or a lethal metal. The fact that sulfur dioxide appeared beneficial is not inconceivable. The same result has been reported in a number of other independent studies. Further, sulfur is a mineral often added to fertilizers to enhance productivity. Thus, at least in moderate quantities, it could increase crop yields of both corn and soybeans.

The power plant in our study increased output substantially over the years of observation permitting a glimpse of the history of the dose-response curve. Across both soybean and corn (except for corn in 1978), the size of the response in relation to proximity to the power plant plume grew larger over time.

Farms which were relatively close *to* the power plant plume received more damage over time or as more pollutants were emitted by the plant. The time series thus confirms the general results of the cross-section analysis. Examining the historical data more closely, we found that the dose response curve grew more steep in proportion to the total amount of coal burned. This result suggests that the factor which is harming crop yields is not reduced when one shifts from high sulfur to low sulfur coal. The harm to crop yields increased in proportion to the tonnage of coal burned, not the tonnage of sulfur emitted. Again, the data points away from fulfur dioxide and towards some other component of the plume from a coal fired generator.

Another result of this study is that mitigation is possible on the farm. Although none of the farmers in the study consciously take steps to reduce the consequences of air pollution, many of the farmers add lime to their soils when they become acidic. Of course, one of the possible causal routes of damage by air pollution is the acidification of the soil. Thus, if farmers add lime to their soils when necessary, the harmful effect of the air pollution could be reduced. The results of regressions with and without lime as an independent variable indicate that lime does partially reduce the harmful effect of air pollution, although obviously this reduction does have a cost. The evidence does give at least some credence to the theory that one causal route of damage is through acidification of the soils.

B. METHODOLOGICAL SUCCESS

There are two independent methodologies used, each based on correlation with predictions of the meteorological model. The meteorological model was found to be reasonably accurate for the purposes of this study although near field (less than 10 km) and far field (greater than 100 km) predictions may be somewhat inaccurate.

The interview methodology for individual farms was found to be basically unsuccessful. The method is time consuming and yields results of questionable accuracy and validity. Regression results were found to be non-significant for this method, due in part to the small sample size and in part to the large fluctuations in the data. If this method is used for data gathering in the future, we recommend using interviewers from the area near the case-study site.

The county data analysis was basically successful. Regression coefficients were significant for certain parameters and dose-response coefficients for air pollutant effects were derived. Problems which beset this technique, however, included:

- changes in Census of Agriculture between different years;
- variations in soil type which were not quantifiable at this site;
- non-availability in the Census of certain useful parameters;
- smallness of the emission source.

Depsite these problems, the method did show realistic differences in the response of the two crops and differences in the mechanisms of wet and dry deposition.

The approach taken here is somewhat parallel to the epidemiological approach often taken relative to health effects of air pollution. We had available a partially compiled (by county) statistical data set which was correlated with air pollution and other variables. The success of the county data analysis shows that there is definite potential of this epidemiological approach for agricultural yields.

C. RECOMMENDATIONS FOR FUTURE RESEARCH

It is clear from the preceding conclusions that although the regressions did not show dramatic correlations or high levels of yield change, they did demonstrate the potential of the county data analysis. The relatively small size of the source coupled with soil variations caused some uncertainty in assigning the variation in yield to air pollution dose. It is not particularly surprising that this should occur in this first test case-study.

The authors recommend that the county data approach be pursued rather than the on-site interview approach. The county data approach can be conducted quickly with only limited on-site checking for soil condition, genetic variability, production techniques, and other important variables. The authors feel that exploration of this approach with 3-4 case study sites (using various crops) could result in complete definition of a usable method of determining yield affects of acidic pollution. Such study should more carefully explore soil variation, meteorological factors and background pollutant concentrations across a variety of sites. The usefulness of the technique in more highly urbanized areas could also be ascertained.

As is typical with individual experiments, this study causes more questions than it answers. For instance:

- What is the harmful component of the power plant plume which causes distant damages?
- Why are damages proportional to coal tonnage and not to sulfur emitted?

- Would the results change if the overall level of pollution increased?
- Are other major crops equally susceptible to air pollution?

Only further planned (laboratory) and unplanned (epidemiological) experiments can answer these questions.

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